US-PAT-NO: 6514865

DOCUMENT-IDENTIFIER: US 6514865 B1

TITLE: Method of reducing interlayer dielectric thickness variation feeding into a planarization process

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Detailed Description Text - DETX (5):

In various illustrative embodiments, the processing step j 105 may involve **high-density plasma** deposition of an **oxide** (e.g., **Ge oxide**), a nitride (e.g., GaAs nitride), an oxynitride (e.g., GaP oxynitride), silicon dioxide (SiO.sub.2), a nitrogen-bearing **oxide** (e.g., nitrogen-bearing SiO.sub.2), a nitrogen-doped **oxide** (e.g., N.sub.2 -implanted SiO.sub.2), silicon nitride (Si.sub.3 N.sub.4), silicon oxynitride (Si.sub.x O.sub.y N.sub.z), and the like. For example, the processing step j 105 may involve **high-density plasma** deposition of silicon dioxide (SiO.sub.2) as a portion of an interlayer dielectric layer, filling in gaps between structures, such as metal structures (conductive interconnect lines, and the like), formed on the workpiece 100, as described more fully below in conjunction with FIGS. 3--7.

Detailed Description Text - DETX (12):

The first dielectric layer 400 may be formed from a variety of dielectric materials and may, for example, be an **oxide** (e.g., **Ge oxide**), a nitride (e.g., GaAs nitride), an oxynitride (e.g., GaP oxynitride), silicon dioxide (SiO.sub.2), a nitrogen-bearing **oxide** (e.g., nitrogen-bearing SiO.sub.2), a nitrogen-doped **oxide** (e.g., N.sub.2 -implanted SiO.sub.2), silicon nitride (Si.sub.3 N.sub.4), silicon oxynitride (Si.sub.x O.sub.y N.sub.z), and the like. **In** one illustrative embodiment, the first dielectric layer 400 is comprised of a silicon dioxide (SiO.sub.2) having a thickness t.sub.d1 of approximately 6000 .ANG., which is formed by a **high-density plasma** (HDP) deposition process.

Detailed Description Text - DETX (14):

The second dielectric layer 500 may be formed from a variety of dielectric materials and may, for example, be an **oxide** (e.g., **Ge oxide**), a nitride (e.g., GaAs nitride), an oxynitride (e.g., GaP oxynitride), silicon dioxide (SiO.sub.2), a nitrogen-bearing **oxide** (e.g., nitrogen-bearing SiO.sub.2), a nitrogen-doped **oxide** (e.g., N.sub.2 -implanted SiO.sub.2), silicon nitride

(Si.sub.3 N.sub.4), silicon oxynitride (Si.sub.x O.sub.y N.sub.z), and the like. **In** one illustrative embodiment, the second dielectric layer 500 is comprised of silicon dioxide (formed using tetraethyl orthosilicate (TEOS)) having a thickness t.sub.2 of approximately 10,000 .ANG., which is formed by a **high-density plasma** (HDP) deposition process.

Detailed Description Text - DETX (16):

The first dielectric layer 600 may be formed from a variety of dielectric materials and may, for example, be an **oxide** (e.g., **Ge oxide**), a nitride (e.g., GaAs nitride), an oxynitride (e.g. GaP oxynitride), silicon dioxide (SiO.sub.2), a nitrogen-bearing **oxide** (e.g., nitrogen-bearing SiO.sub.2), a nitrogen-doped **oxide** (e.g., N.sub.2 -implanted SiO.sub.2), silicon nitride (Si.sub.3 N.sub.4), silicon oxynitride (Si.sub.x O.sub.y N.sub.z), and the like. **In** one illustrative embodiment, the first dielectric layer 600 is comprised of a silicon dioxide (SiO.sub.2) having a thickness t.sub.d1 of approximately 750 .ANG., which is formed by a **high-density plasma** (HDP) deposition process.

DOCUMENT-IDENTIFIER: US 20040026374 A1

TITLE: Assembly line processing method

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Summary of Invention Paragraph - BSTX (67):

[0065] **In** another aspect, an apparatus to perform semiconductor processing includes a **high density** inductive coupled **plasma** generator to generate **plasma; and a process** compartment housing the **plasma** generator. The method can provide deposition of copper metal from Cu hfacI and plasma (gas), Cu hfacII and plasma (gas), CuI.sub.4 and plasma (gas), CuCl.sub.4 and plasma (gas), and organo metallic copper and plasma (gas); of titanium nitride from TDMAT and plasma (gas), TDEAT and plasma (gas), TMEAT and plasma (gas), TiCl.sub.4 and plasma (gas), TiI.sub.4 and plasma (gas), and organo metallic titanium and plasma (gas); of tantalum nitride from PDMAT and plasma (gas), PDEAT and plasma (gas), and organo metallic tantalum and plasma (gas); of aluminum **oxide** from trimethyl aluminum (TMA) and ozone, TMA and water vapor, TMA and oxygen, organo metallic aluminum and plasma (gas); and other oxides such as hafnium **oxide,** tantalum **oxide,** zirconium **oxide**; wherein gas is one of N.sub.2, H.sub.2, Ar, He, NH.sub.3, and combination thereof.

DOCUMENT-IDENTIFIER: US 20030165632 A1

TITLE: Method of reducing stress induced defects in an HDP-CVD process

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Summary of Invention Paragraph - BSTX (5):

[0003] **As** devices become smaller and integration density increases, the **high density plasma** chemical vapor deposition (HDP-CVD) process has become a key process due to its gap-filling capability. **In** particular, **high density plasma** (HDP) processes, such as electron cyclotron resonance (ECR) processes and induced coupling **plasma** (ICP) processes have been found to produce high-quality silicon dioxide and silicon nitride layers. Generally, HDP-CVD provides a high density of low energy ions resulting in higher quality films at lower deposition temperatures, compared to for example, PECVD. HDP-CVD is particularly ideal for forming interlayer dielectric (ILD) **oxide** layers because of its superior gap filling capability. Generally, both sputtering and deposition take place simultaneously, resulting in a deposition/sputter ratio (D/S) ratio that may be adjusted according to process parameters.. **In** an HDP-CVD deposition process, for example, a bias power is coupled to the semiconductor wafer to attract ions which sputter (etch) the wafer during deposition (re-sputtering effect), thereby preventing a phenomena known as crowning where the deposition material converges over the trench before an etched feature opening is completely filled with the deposition material. The deposition rate may therefore be more finely tuned to improved CVD deposition properties to, for example, avoid crowning.

Summary of Invention Paragraph - BSTX (6):

[0004] The D/S (deposition-sputtering rate ratio) is a commonly used measure of the gap-filling capability of the process. Among the disadvantages of a lower D/S ratio include the possibility of "corner clipping" or "edge erosion" along the edges of metal lines and the lowering of processing throughput since it requires a relatively longer period of time to achieve the formation of the HDP-CVD **oxide**. The **high density of the plasma** can result in significant heating of the wafer during deposition requiring a cooled wafer chuck to cool the wafer during deposition. Generally, higher sputtering rates (lower D/S ratios) tend to increase the temperature of the wafer substrate and as such high temperatures have been necessary at the early stages of gap filling when low deposition/sputter ratios (typically less than 4) are necessary to fill the

high aspect ratio channels. Temperatures as high as 400.degree. <u>**C.**</u> have been observed and at these temperatures significant distortion of the metal features and circuitry have been observed.

DOCUMENT-IDENTIFIER: US 20040026371 A1

TITLE: Two-compartment chamber for sequential processing method

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Summary of Invention Paragraph - BSTX (55):

[0053] **In** another aspect, an apparatus to perform semiconductor processing includes a **high density** inductive coupled **plasma** generator to generate **plasma; and a process** compartment housing the **plasma** generator. The method can provide deposition of copper metal from Cu hfacI and plasma (gas), Cu hfacII and plasma (gas), CuI.sub.4 and plasma (gas), CuCl.sub.4 and plasma (gas), and organo metallic copper and plasma (gas); of titanium nitride from TDMAT and plasma (gas), TDEAT and plasma (gas), TMEAT and plasma (gas), TiCl.sub.4 and plasma (gas), TiI.sub.4 and plasma (gas), and organo metallic titanium and plasma (gas); of tantalum nitride from PDMAT and plasma (gas), PDEAT and plasma (gas), and organo metallic tantalum and plasma (gas); of aluminum **oxide** from trimethyl aluminum (TMA) and ozone, TMA and water vapor, TMA and oxygen, organo metallic aluminum and plasma (gas); and other oxides such as hafnium **oxide,** tantalum **oxide,** zirconium **oxide**; wherein gas is one of N.sub.2, H.sub.2, Ar, He, NH.sub.3, and combination thereof.

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	14213	((high adj density) with plasma) and (Zn or Cd or Hg or B or Al or Ga or In or Ti or C or Ge or Sn or Pb or As or N or P or Sb or Bi)	US-PGPUB; USPAT	OR	OFF	2006/04/05 08:39
L2	9690	((high adj density) with plasma) and (oxide same (Zn or Cd or Hg or B or Al or Ga or In or Ti or C or Ge or Sn or Pb or As or N or P or Sb or Bi))	US-PGPUB; USPAT	OR	OFF	2006/04/05 08:37
L3	6969	2 and temperature and (substrate or wafer or workpiece)	US-PGPUB; USPAT	OR	OFF	2006/04/05 08:40
L4	6966	3 and (method or process or manufactur$3 or fabricat$4)	US-PGPUB; USPAT	OR	OFF	2006/04/05 08:40
L5	3324	((high adj density) with plasma) same oxide same (Zn or Cd or Hg or B or Al or Ga or In or Ti or C or Ge or Sn or Pb or As or N or P or Sb or Bi)	US-PGPUB; USPAT	OR	OFF	2006/04/05 11:38
L6	2294	5 and temperature and (substrate or wafer or workpiece)	US-PGPUB; USPAT	OR	OFF	2006/04/05 08:40
L7	2294	6 and (method or process or manufactur$3 or fabricat$4)	US-PGPUB; USPAT	OR	OFF	2006/04/05 08:40
L8	1931	7 and @ad<"20040315"	US-PGPUB; USPAT	OR	OFF	2006/04/05 12:13
L9	184	((high adj density) with plasma) same oxide same (Zn or Cd or Hg or B or Al or Ga or In or Ti or C or Ge or Sn or Pb or As or N or P or Sb or Bi)	USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/04/05 11:43
L12	2829	438/788,798,787,792,778.ccls.	US-PGPUB; USPAT	OR	ON	2006/04/05 12:14
L13	2516	12 and @ad<"20040315"	US-PGPUB; USPAT	OR	ON	2006/04/05 12:15
L14	1742	13 and plasma	US-PGPUB; USPAT	OR	ON	2006/04/05 12:15
L15	626	14 and (high adj density)	US-PGPUB; USPAT	OR	ON	2006/04/05 12:15
L16	431	((high adj density adj plasma) and oxide and (substrate or wafer or workpiece) and temperature).clm.	US-PGPUB; USPAT	OR	ON	2006/04/05 12:16
L17	391	16 and @ad<"20040315"	US-PGPUB; USPAT	OR	ON	2006/04/05 12:17